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THE LARVAL FORM OF THE HETEROMI (PISCES)

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The distinctive order Heteromi (Lypomi, Halosauriformes, or Notacanthiformes) includes about 25 species arrayed among about eight genera within the three families Notacanthidae, Halosauridae, and Lipogenyidae. All appear to be bottom fishes which, as adults, live between a few hundred and about 3500 meters. The placement of the order, which has been divided into two by many authors (Gill, 1889; Goode and Bean, 1896:129, 162; Berg, 1940:453; and Lagler, Bardach and Miller, 1962:40), within the teleostean hierarchy has been problematical. The most penetrating study of possible relationships is that of Marshall (1962) who emphasized the unity of the order, and allied it with the true eels or Apodes, chiefly on the basis of significant resemblances in swimbladder structure. The group was also recognized as a distinct order allied to the true eels within their superorder Elopomorpha by Greenwood, Rosen, Weitzman and Myers (1965) — a treatment in which I wholly concur.

The reproductive biology of the group has been a complete enigma. Neither eggs nor larvae have been reported, although Marshall (1962) and Greenwood *et al.* (1965) suggested that if the Heteromi shared common ancestry with the apodal fishes, a leptocephalus-like young should be expected. Similar speculation was included in the review of reproduction in the group provided by Mead, Bertelsen and Cohen (1964:583). It is thus most gratifying to report here on a single, relatively large leptocephalus taken during the midwater trawling program of the International Indian Ocean Expedition. It is broken and badly damaged, but has the typical shape and transparency of a relatively large eel leptocephalus and head structure unmistakably that of a halosaur, probably of the genus *Aldrovandia*. This metamorphosing young was taken as follows:

R/V *Anton Bruun,* Cruise VI, Sta. 351D, APB label 7354; 29 June 1964; Southern Indian Ocean between 31°45′S, 65°08′E and 32°26′S, 65°05′E; 0359 to 1507 hrs.; 10-foot Isaacs-Kidd trawl equipped with Foxton Trousers (Foxton, 1963) set to trip at 350 m; maximum depth of haul 1786 m; probable depth of capture below 125 m; depth of bottom 4480 m. MCZ catalog number 43994.

The body of this specimen which lacks the terminal part is 263 mm long and is composed of 250 somites. It lacks much of its skin, and the anal and the ventral fins are either undeveloped or were lost during capture. The flanks are densely stippled with fine black pigment. The head is similarly but more darkly colored. Along the ventral profile are series of black spots, each continuous with its mate across the ventral midline and connected with the adjacent spots mid-ventrally by a fine line of dense pigment. These spots probably occur throughout the length of the fish, but both skin and pigment are missing in many areas (Fig. 1). Within or surmounting each ventral spot, at least anteriorly, is a pore which may be the precursor of the series of ventral luminous organs seen in *Aldrovandia rostrata* (Günther, 1887, pl. 59, fig. A). Spots and pores occur on every fourth or fifth somite, a relationship similar to that between light organs and rows of scales in certain species. Prior to preservation, the body was nearly as transparent as that of most eel leptocephali. The pectoral fin, which is set close behind the gill opening, is formed of twelve rays. The dorsal fin, badly damaged but including at least eight rays, is short-based and situated relatively far forward compared to that of other halosaurs, suggesting a substantial relative shortening of the post-dorsal part of the body with growth. The anus cannot be found.

The head (Fig. 1) is about as broad as deep and terminates anterior to the gape in a prolonged fleshy snout. The gill openings are broad and continue anteriorly to near the symphysis of the lower jaw. Branchiostegal membranes are free from each other and from the isthmus. The gill membrane is thin and fragile. None of the osteological peculiarities noted by Marshall (1962:253) can be ascertained. Gill rakers are present and lathlike, are about as long as the opposite filaments, and number 4 + 1 + 14 on the first arch.

Jaws are poorly developed and bear teeth only at the tip of the mandible. Upper jaw bones are similar in structure to adult *Aldrovandia,* i.e. a somewhat flattened maxillary bone that abuts anteriorly on the end of the premaxillary which, with its

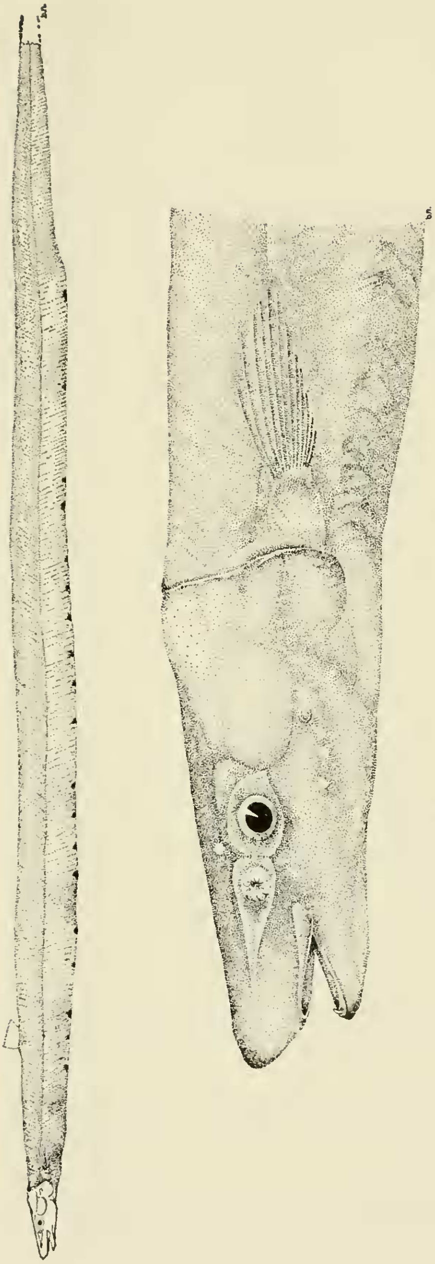

Figure 1. Metamorphosing leptocephalus of *Aldrovandia* sp.

opposite partner, courses transversely across the gape. Pores, presumably sensory, occur on the cheek (Fig. 1) and another pair is situated on the top of the head above the anterior edge of the orbit.

The capture of a specimen, small but of adult appearance, which has been identified provisionally as *Halosaurus nigerrimus* Alcock, 1899, indicates that halosaurs can complete their metamorphosis in midwater. This fish, 185 mm long, was also caught in the more southern latitudes of the Indian Ocean, as follows:

R/V *Anton Bruun*, Cr. VI, Sta. 349B, APB label 7332; 26 June 1964; 26°24′S, 65°02′E to 26°44′S, 65°05′E; 0830 to 1425 hrs.; 10-foot Isaacs-Kidd trawl equipped with Foxton Trousers set to trip at 350 m; maximum depth of haul 1470 m; probable depth of capture below 125 m; depth of bottom 4571 m. MCZ catalog number 43993.

These specimens thus clearly show that heteromous fishes have leptocephalus young so strikingly similar to those of the true eel that a close relationship between the two orders must be recognized, and that the young of at least some of these benthic fishes are pelagic. Thus either a spawning migration of the adults must occur or, less likely, buoyant eggs spawned on the bottom must rise through a water column of substantial height.

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LITERATURE CITED

Berg, L. S.

1940. Classification of fishes both recent and fossil. Trav. Inst. Zool. Acad. Sci. U.R.S.S., **5**:87-512. English trans., Ann Arbor, Michigan, 1947, 517 pp.

Gill, T. N.

1889. The halosauroid fishes typical of a peculiar order. Amer. Nat. **23**:1016-1017.

Foxton, P.

1963. An automatic opening-closing device for large plankton nets and mid-water trawls. Jour. Mar. Biol. Assn. U.K., **43**:295-308.

GOODE, G. B., and T. H. BEAN
1896. Oceanic Ichthyology . . . U.S. Nat. Mus., Spec. Bull. 2, 553 pp., 123 pls.
GREENWOOD, P. H., D. E. ROSEN, S. H. WEITZMAN, and G. S. MYERS
1965. Phyletic studies of teleostean fishes with a provisional classification of living forms. Bull. Amer. Mus. Nat. Hist., in press.
GÜNTHER, A.
1887. Report on the Deep-sea fishes collected by H.M.S. *Challenger* during the years 1873-76. Rep. Sci. Res. ''Challenger,'' Zool., **22**, 335 pp.
LAGLER, K. F., J. E. BARDACH, and R. R. MILLER
1962. Ichthyology. New York, 545 pp.
MARSHALL, N. B.
1962. Observations on the Heteromi, an order of teleost fishes. Bull. British Mus. (Nat. Hist.), Zool., **9** (6) :251-270.
MEAD, G. W., E. BERTELSEN and D. M. COHEN
1964. Reproduction among deep-sea fishes. Deep-Sea Res., **11**:569-596.